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Impact of Recessions on Equity Mutual Fund Allocations

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Abstract: We show that the exposure of US equity mutual funds to Carhart's four-factor model vary with the state of the economy. In bad times, equity mutual funds underinvest in small and value stocks. We find that these reactions can be explained by the change in riskiness of small and value firms. Small firms are more opaque than larger firms and have a harder time coping with the credit crunch that generally follows an economic crisis. Value firms, which derive most of their value from physical capital, suffer more from contractions than growth firms, which in turn obtain the majority of their value from future growth opportunities. Further, we find that there has been a change in allocation to the market proxy between a first time period (1968-88) and a second period (1989-2011). While, during the first period, managers respond to a recession by underinvesting in the market proxy, the contrary happens during the second period. We do not find that the rather large change in the mutual fund industry with a vast increase in index funds can explain this behavior during contractions. Rather, it seems more plausible that the increased financial integration combined with a home bias during times of economic turmoil account for more of the explanation. Ultimately, our results are not completely reliable since the data suffer from a survivorship bias.

Keywords: Fund Allocation in Recession, Market Portfolio, Small Minus Big, High Minus Low, Momentum

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1 Introduction

At the end of year 2010 mutual fund investment constituted about 23% of the US household financial assets.[3] Knowing how mutual funds behave and perform is important in order to understand the performance of household investments. Lots of previous research conducted on mutual fund performance has focused intensely on how different fund characteristics affect mutual fund performance. To name a few there is Carhart's (1997) research on persistence in mutual fund performance where he demonstrates that characteristics such as expense fee, performance in previous years and total net asset have a major implication on the abnormal return of a fund. However, in more recent research more stress has been put on the implications of market conditions on fund performance. Among others Kacperczyk et.al. (2011) demonstrated that depending on booms and recessions fund managers alternates between stock picking and market timing. Also, research by Robert Kosowski (2006) has shown that a contracting economy have a significant impact on the abnormal performance of mutual funds. In his paper he showed that US mutual funds tend to have a positive alpha during recessions and a negative alpha during expansions.

Continuing on this more occurring trend in mutual fund research; to allow the conditions of the economy to have a unique effect, the purpose of this thesis is to investigate what impact market conditions have on the investment allocations of equity mutual funds. We believe that this area is still relatively unexplored.

During recessions, as the economy heads south, many investors grow more and more fearful as they watch the values of their portfolios slide relentlessly. Every investor has different theories on how to respond. For instance, some intend to "ride out the storm" while others simply withdraw money from the markets and invest in safer asset classes. Without knowing just how low the value of stocks will go, it can be difficult to decide whether to buy anything at all. The problem becomes even more stifling when trying to choose mutual funds during times of economic turmoil.

Mutual funds come in all sizes and flavors, each one having a distinct investment style. But do they stick to their previous investment style during recessions even though there sometimes are safer and less risky asset classes to choose from when markets act irrationally? It would be reasonable to assume that many funds play it safe during a financial crisis because the managers do not want to risk being put to blame for a poor

[3] According to the Investment Company Fact Book, 2011.

performance (which is rather possible). Therefore, it would be no surprise if many funds choose to go along with the rest of the market (i.e. follows some index like the S&P500).

In order to determine the allocation of mutual funds we will use the model proposed by Carhart (1997), where he uses four factors; market excess return, small minus big, high minus low and the momentum effect. To discern the effects of a recession, we use a dummy variable which takes on the value of 1 for every time-interval that the National Bureau of Economic Research has defined as a contraction. Previous research done in the same area, also using Carhart's four-factor model, by Scott Cederburg (2008) came to the conclusion that investors do not search for managerial skill during recessions to the same extent that they do during expansions. Instead, they are more concerned with the aggregate risk factors. To find out which risk factors that these mutual funds are more exposed to during expansion and recessions we perform a return-based analysis using Carhart's four factor model, which resembles a style analysis as introduced by Sharpe in (1992). Because the benchmarks in Carhart's model are all equity based we have decided to only focus on equity mutual funds.

Instead of analyzing the difference in monthly returns for every equity mutual fund during the sample period, we create two weighted portfolios; one weighted equally and the other by size (as defined by the total net assets of the mutual funds). Furthermore, we also split our time span into two separate periods 1968-1988 and 1989-2011. We find that our results vary depending on whether the economy is defined as being in an expansion or the opposite; a contraction. The results show that US equity mutual funds are less exposed to both the SMB and HML factor during an economic crisis. This is mainly due to the underperformance by small and value companies that economic instability causes. The market portfolio factor, on the other hand, reacts inconsistently to recessions when comparing the two separate periods. The first period (1968-88) shows an underinvestment, while the second period (1989-2011) shows an increased investment in the market proxy. Our theory for this phenomenon is that the recessions in the two periods are different in their extent and magnitude. The earlier recessions were more isolated to one country, while the more recent ones were spread more globally, due to a more integrated linkage of financial markets. As a result, in the early recessions investors could opt to invest in foreign markets in order to escape the national economy instabilities. But in the later recessions it was much harder to avoid the economic downturns, since the whole world was affected. Moreover, because the investors were more familiar with and had more

information of the home market, many of them chose to stay with their investments in the US – hence exhibiting a home bias during the second period (1989-2011).

The thesis is arranged as follows. Section 2 discusses relevant previous research. Section 3 will present and discuss the data and relevant data mining problems. Section 4 presents the methodology used for the regression analyses and construction of the portfolios. Section 5 presents the results. Section 6 focuses on discussing and examining the possible effects of survivorship bias. Section 7 analyses and interprets the results. Section 8 sums up the thesis in a conclusion.

2 Previous Research

There has been much research done about the performance of mutual funds. The most frequent research-question on the subject is most likely whether investment managers actually add value for their clients or whether the latter would have been better off placing their money in a passive index, such as the S&P500 - which in literature and research is repeatedly used as a proxy for the market portfolio[4]. One of the most prevalent authors on the subject of mutual fund performance is Mark M. Carhart (1997). In his article he finds that the persistence of mutual funds performance, for example why the best performing funds keep being top performers, has not by any means so much to do with manager's ability to pick stocks (which often is a public belief/common misconception) as with the expenses and transaction costs of the funds. In fact, most funds underperform in quantity with their costs of investing, whereas the best performing mutual funds can at least cover these expenses and generate positive returns.

A recent paper by Kacperczyk, Nieuwerburgh and Veldkamp (2011) looks at performance separately in contractions and expansions. Those who alter their investment styles[5] most over the different cycles of the economy are the ones who generate the highest returns. In recessions, the average manager displays a greater capability of timing the market while in expansions he or she has a larger aptitude for stock selection. They find that in expansions stock picking is more dominant while in contractions, market timing dominates[6].

A paper by Giannetti & Laeven (2012), as of yet unpublished, looks at the local bias of US equity mutual funds conditional on the state of the economy. While earlier research attempts to explain the local bias by information advantage and familiarity concerns, using the VIX index and a sentiment condition, Giannetti & Laeven (2012) are the first to prove that conditional on market conditions – the local biases vary over time[7].

[4] Roll's critique claims that this proxy for the market portfolio is lacking since the market portfolio should include all available investment opportunities, such as stocks but also collections of stamps, fine wines, real estate and so on.
[5] They look at alternations between stock picking and market timing, as defined by separate models.
[6] Market timing is the procedure of trying to foresee the best time to trade stocks, i.e. buy and sell stocks.
[7] When the economy is in a good state (VIX index displays low volatility), US equity mutual funds hold more international stocks while they in a state of economic uncertainty (VIX index is high) exhibit a larger local bias (see Giannetti & Laeven, 2012, for further explanation).

To the best of our knowledge, no previous study has aimed to discern a pattern between market conditions and the exposures of US equity mutual funds to the Carhart four-factor model (Carhart, 1997). Therefore, we feel that this paper is unique since it aims to determine firstly how the exposures change over time as the economy fluctuates between expansions and contractions. A reasonable assumption is that many investors become more risk averse during contractions. Although a recession represents systematic risk - which cannot be diversified away, we hypothesize that managers will tend to allocate more assets to the market portfolio to try and get rid of idiosyncratic risk during a crisis.[8]

Extensive research has been done on the different investment styles of mutual funds. The concept of style analysis was introduced by Sharpe (1992). While the style analyses by Sharpe, and many others in the years following his article, are done on all types of mutual funds (such as equity and fixed income funds), we limit our study to look at and draw conclusions for equity mutual funds only. Hence, we do not have to include benchmarks such as bonds, be it US treasury bonds or international bonds.

[8] Investing all assets in the market portfolio means that you are only exposed to systematic risk since the market portfolio is the most diverse investment possible.

3 Data

3.1 Mutual funds data

In this study we have made use of a combination of data, obtained from a number of sources. From the WRDS (Wharton Research Data Services) we use the CRSP (Center for Research in Security Prices) dataset to obtain data on US mutual funds. Since some companies close down their worst performing funds (Bodie, Kane & Marcus, 2011), survivorship bias is a problem that some databases suffer from. However, the CRSP database contains both active and inactive mutual funds in the United States. Hence, the different datasets we have acquired do not inherently have any survivorship bias.

From CRSP we start with attaining data from the *fund summary*, which is updated quarterly. The data range is from January 1968 to December 2011. Using "Lipper Asset Code", we drop funds which are described as TX (Taxable fixed income fund) or MB (Tax free fixed income fund). Also dropping the mutual funds whose Lipper Asset Code was missing ensures that we are left with only US equity mutual funds.

From CRSP we acquire a separate dataset with a corresponding time period of January 1968 – December 2011 that contains the monthly return and total net asset value of US mutual funds. Merging with the previous dataset obtained from CRSP's fund summary via the specific fund numbers as assigned by CRSP in each dataset, we are left with 30 518 unique US equity mutual funds.

Table 1

Descriptive Statistics

The following table provides summary statistics for the data used in this study. The time period is from 1968-2011 and is split up into two parts 1968-88 and 1989-2011. The reason why the recessions are split up into two periods is partly because the early and the later recessions are different in extent and magnitude (as will be discussed later in *section 7, analysis*) but mostly because a different result is obtained between them (*see section 5, results and section 7, analysis*). *Avg TNA* is the average total net asset of the equity mutual funds in the sample and is measured in millions of dollars. *Avg Return* is the average monthly return of the equity mutual funds. *Avg age* is the average age of the equity mutual funds in the sample (measured in years). The *Avg duration of recessions* is measured in number of months.

Time period	Total Number of funds	Avg TNA ($ millions)	Avg Return	Avg age (years)	Number of recessions	Avg duration of recession	Number of obs.
1968-1988	845	70.93	0.980%	29.4	4	12.25	89495
1989-2011	30518	349.59	0.481%	6.2	3	11.33	2560981
1968-2011	30518	340.18	0.498%	6.9	7	11.86	2650476

3.2 Fama - French factors

From WRDS we attain data on the monthly Fama- French factors from January 1968 to December 2011. We join this data to the previously merged dataset via the corresponding monthly dates.

The Fama- French research portfolios and factors include Small Minus Big (SMB), High Minus Low (HML), market excess returns (MKTRF) and Momentum (UMD[9]). These are all based on American stocks. The factors are constructed from the intersection of two portfolios ranked by size (Big (B) and Small (S)). Size is measured by market equity, i.e. price multiplied by shares outstanding. Furthermore, three other portfolios are created, ranked by book equity (BE) divided with market equity (ME), creating High (H), Medium (M) and Low (L). The two size portfolios are then combined with the three book-to-market ratio portfolios. In total six portfolios are created; S/H, S/M, S/L, B/H, B/M, B/L (Fama & French, 1996).

Figure 1: Formation of SMB & HML

		Book-to-Market ratio		
		High	Medium	Low
Size	Small	S/H	S/M	S/L
	Big	B/H	B/M	B/L

SMB is the difference, each month, between the average of the returns of the three small-stock portfolios (S/H, S/M, S/L) and the average of the returns of the three big-stock portfolios (B/H, B/M, B/L).

HML is the monthly difference between the average return of the two high book-to-market equity portfolios (S/H, B/H) and the two low book-to-market equity portfolios (S/L, B/L).

The third factor, which is market excess return, denotes the excess return on the market proxy, which (in the dataset) is the value-weighted return on all NYSE, AMEX and NASDAQ stocks minus the one-month Treasury bill rate.

[9] UMD signifies Up Minus Down, which is the sort of trend following strategy that momentum implies.

Momentum, which is the last factor used in the model for performance measurement, is created in a similar fashion as SMB and HML; by six weighted portfolios formed on size and prior returns.

Figure 2: Formation of UMD

		Prior returns		
		High	Medium	Low
Size	Small	S/H	S/M	S/L
	Big	B/H	B/M	B/L

The portfolios are formed monthly. The size breakpoint is the median NYSE market equity, which means that stocks above the median are considered to be "big" in size and vice versa. The monthly prior (2-12)[10] return breakpoints are the 30th and 70th NYSE percentiles, which gives the three intervals; low, medium and high prior returns. Momentum is then the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios (French, 2012).

3.3 Business Cycle Dating Procedure

To identify the macro economic trends we use information from NBER (National Bureau of Economic Research)[11]. The bureau does not have a set definition of economic activity. To classify contractions and expansions in the economy, they use several broad indicators of the economy such as real GDP, employment and real income. However, they also take into consideration values that do not cover the entire economy such as the Federal Reserve's index of industrial production (IP) and real sales (NBER, 2012). Hence, there is no model that we could include which describes how the business cycle is defined in terms of recessions and expansions – this is a judgment made by the NBER which we have followed.

Recessions, however, are defined as beginning at the peak of the business cycle and coming to an end at the through.

[10] 2-12 indicates that the momentum factor is calculated on the returns t-12 to t-2, i.e. 12 to 2 months before date t.
[11] Same procedure is used by Kacperczyk, Nieuwerburgh and Veldkamp (2011).

Table 2

Recessions 1968-2011, NBER

The following table provides information about the recessions used in this thesis. The information is provided by NBER and all the data are quoted in number of months.

Peak	Trough	Length	Previous trough to this peak	Trough from previous trough	Peak from previous peak
December 1969	November 1970	11	106	117	116
November 1973	March 1975	16	36	52	47
January 1980	July 1980	6	58	64	74
July 1981	November 1982	16	12	28	18
July 1990	March 1991	8	92	100	108
March 2001	November 2011	8	120	128	128
December 2007	June 2009	18	73	91	81

3.4 Data issues

It appears that all 845 equity mutual funds from the early period survived into the later time period (see table 1). However, it does seem implausible that in a sample free from survivorship bias, none of these mutual funds would be terminated as time passes. In light of this, we recognize a problem with the *Lipper classification code* used from the CRSP-database. The classification code, indicating either an equity or fixed income fund, was introduced first on December 31, 1999 (CRSP, 2011). Therefore, our sample does not contain any equity mutual funds which seized to operate before the new millennia arrived. Mutual funds from January 1968 and onward which survived until December 31, 1999, were assigned the mentioned character code. Since we make use of this code in order to only include equity mutual funds (thereby excluding fixed income funds), we create a data-sample which unfortunately suffer from a survivorship bias. A more extended look into the average age of funds in table 3 (below), gives us further confirmation of a survivorship bias.

Table 3

Age Statistics, Survivorship bias

The following table provides a more detailed view of the age of equity mutual funds used in the study. *Avg Age* is the average age of the mutual funds in the sample (measured in years). *Std. Dev of age* shows the standard deviation of age. *Minimum-* and *Maximum age* illustrates the minimum and maximum age, measured in years, for the listed periods.

Time period	Avg Age (years)	Std. Dev. of age	Minimum age (years)	Maximum age (years)
1968-1979	39.8	4.08	23	43
1980-1989	23.0	4.30	10	31
1990-1999	12.2	4.90	0	21
2000- 2011	4.0	2.98	0	11
1968-1970	41.0	3.04	32	43
1971-1973	38.2	2.56	29	40
1974-1976	34.0	4.08	28	37
1977-1979	32.0	2.57	23	34
1980-1982	28.3	2.95	19	31
1983-1985	24.3	3.93	15	28
1986-1988	22.0	3.54	12	25
1989-1991	18.3	3.89	9	22
1992-1994	16.0	3.68	6	19
1995-1997	11.8	3.87	2	16
1998-1999	8.8	4.09	0	13

Perceptive observers may note that the minimum age during the periods (above in table 3) indicates that there is a chance that, for example, an equity mutual fund trading in 1968 could have been terminated in 23 years (the minimum age for the period 1968-79). This would indicate that a fund which was active in 1968 would have been terminated before the new millennia arrived (and CRSP's *Lipper Classification Code* with it). Unfortunately this is not the case, as can be seen in table 7 in appendix. Therefore, we are forced to accept a survivorship bias in the dataset.

4 Methodology

The methodology used in this thesis is similar in many ways to Carhart's study regarding persistence in mutual fund performance. The idea behind our allocation analysis is to be able to determine the investment exposure of equity mutual funds with regard to Carhart's four factors without knowing the portfolio holdings. We regress the historical fund returns on these benchmarks using the following model.

$$r_{it} = \alpha_{it} + \beta_{1it}MKTRF_t + \beta_{2it}MKTRF_t d_t + \beta_{3it}SMB_t + \beta_{4it}SMB_t d_t + \beta_{5it}HML_t + \beta_{6it}HML_t d_t + \beta_{7it}UMD_t + \beta_{8it}UMD_t d_t + \varepsilon_{it} \quad \text{Equation}(1)$$

$t = 1,2,\dots,T$

Where: [12]

r_{it} is the excess return of a mutual fund over the period *t*.

α_{it} is the mutual fund's abnormal return.

β_{it} shows the exposure of the portfolio to the corresponding factor.

ε_{it} is a residual component of the model with an expected value of zero.

$MKTRF_t$ is the market excess return.

SMB_t is the small minus big factor.

HML_t is the high minus low factor.

UMD_t is the momentum factor.

d_t is the dummy variable for a recession (value of 1= a recession)

The OLS regression model is used to compute the fund allocations.

$$Min \sum_{t=1}^{T} \widetilde{\varepsilon_{i,t}}^2 = Min \sum_{t=1}^{T} (r_{it} - (\alpha_{it} + \beta_{1it}MKTRF_t + \beta_{2it}MKTRF_t d_t + \beta_{3it}SMB_t + \beta_{4it}SMB_t d_t + \beta_{5it}HML_t + \beta_{6it}HML_t d_t + \beta_{7it}UMD_t + \beta_{8it}UMD_t d_t + \varepsilon_{it}))^2 \quad \text{Equation}(2)$$

$t = 1,2,\dots,T$

[12] See the data section for how the factors are created.

In order to find out if fund size matters in the allocation strategies we create two different portfolios. One is weighted equally, the other by size (as defined by total net assets).

4.1 Equally weighted portfolio, ew:

For each month, we generate the return for the weighted portfolio by multiplying the monthly excess return of each US equity mutual fund with the equal weights for the month and summing these up.

$$Return\ of\ ew\ portfolio, month_i =$$

$$= \sum_{i=1}^{N} \frac{1}{\sum mutual\ funds\ month_i} * monthly\ excess\ return, mutual\ fund_j$$

For the entire period of January 1968 – December 2011, we get 528 equally weighted portfolios, i.e. N=528. One portfolio return for each month.

4.2 Value weighted portfolio, vw:

$$Return\ of\ vw\ portfolio, month_i =$$

$$= \sum_{i=1}^{N} \frac{total\ net\ assets, month_i, mutual\ fund_j}{\sum total\ net\ assets, month_i} * monthly\ excess\ return, mutual\ fund_j$$

We begin by dropping equity mutual funds for which the CRSP database has missing values for total net assets. Then, for every month, we create the value weighted portfolio by multiplying the monthly excess return of each US equity mutual fund with their respective weight. The weight (as the first half of the "vw" equation above illustrates) depends on each mutual funds part of the monthly sum of total net assets for all funds. Thus, the more total net assets a mutual fund has a certain month, the larger the weight of that mutual fund. Therefore, the return of the value weighted portfolio each month will resemble the larger mutual funds more.

Our hypothesis is that large equity mutual funds (those with a higher amount of net asset relative to the other equity mutual funds) may play it safer, i.e. have a return which is more similar to that of the *market excess return*, during recessions. This is plausible seeing as the largest mutual funds have the most to lose (in terms of capital under management) if they generate a low return which is beaten by for example the market proxy.

The time span of 1968-2011 for this thesis is a rather long time period if we take into account how fast the financial market actually changes and how much the world has changed, in other aspects, during the past 40 years. In light of this, we believe it might be too rough to analyze all the recessions in one single regression. As a result, we decide to split up the economic crises into two periods where the first period covers January 1968- December 1988 and the second period covers January 1989- December 2011.[13] There are four recessions in the "early" time period and three recessions in the "late" time period.

In similar fashion as before, we create both an equally and a size weighted portfolio in both the early and late time- period. Hence, we get four different portfolios whose returns we regress on the Carhart's factors (1997), as shown in equation 1.

To get an image of how the betas are distributed, we run a regression separately for the monthly return of every US equity mutual funds. Since this is more demanding in terms of computational power, it is necessary to limit the data-set considerably. Hence, we look at only two recessions; the one in the early 1970s created by budget deficits from the Vietnam War and the sub-prime crisis which began in January 2008 and ended in June 2009. The distribution of the betas can be seen in the beta histograms in the Appendix (graphs 1 and 2). Note that no t-statistic is illustrated in these graphs. Even though we have calculated the t-statistics for every estimated beta[14] for the 21 627[15] equity mutual funds during the most recent contraction, we could not - in a mathematically correct way - display the t-statistics for the ranges of estimated betas shown in graph 1 & graph 2. The amount of funds in the data for the earliest recession is drastically less, yet this does little to improve the prospects of a calculation.

[13] The reason as to why we do not create two periods of equal size is that there was a recession from August 1990 to March 1991. We were reluctant to let the more recent time period begin with a recession, and therefore we made this period somewhat larger in order for it to begin with, at least, a couple of years of expansion.

[14] Each mutual fund has eight estimated betas corresponding to it, see equation 1.

[15] The subprime mortgage crisis beginning in 2008 lasted 18 months. For symmetry we used data for 18 months before the crisis and 18 constituting the recession, making the data range July 2007 – June 2009. The amount of equity mutual funds in this period was 21 627.

5 Results

Table 4

Regression results

The following table presents the regression results of the mutual fund allocations for the period *1968-2011*. The left part of the table is the results from the equally weighted portfolio, while the right part is from the value weighted portfolio. The factor *Mktrf* stands for market excess return and it is the return of the market proxy minus the risk-free interest rate. This is considered the most diverse portfolio with no idiosyncratic risk. *SMB* represents the small minus big factor which is measured by market capitalization. *HML* stands for high minus low and is measured by book equity relative to market equity. *UMD* is the momentum factor, calculated on monthly prior (2-12) returns, i.e. returns from 12 months to 2 months before date t. All these factors have their respective dummy variable that takes on the value 1 during recessions and 0 during expansions. The coefficients present the estimated values from the regression (equation 1). Each one of them has their t-value stated in brackets below. The stars (*) after each coefficient signals the significance level of the result.

Time period: Jan 1968 – Dec 2011

	Equally weighted portfolio		**Value weighted portfolio**	
Factor	**Coefficient**	**Std. Dev.**	**Coefficient**	**Std. Dev.**
Mktrf	0.8921*	0.0076	0.8956*	0.0135
	(117.50)		(66.42)	
Mktrf_dum	– 0.0046	0.0185	– 0.0068	0.0223
	(– 0.25)		(– 0.31)	
SMB	0.1664*	0.0133	0.0563*	0.0169
	(12.48)		(3.33)	
SMB_dum	– 0.0515***	0.0338	– 0.0469***	0.0322
	(– 1.52)		(– 1.46)	
HML	0.0108	0.0130	0.0188	0.0147
	(0.83)		(1.28)	
HML_dum	– 0.0746*	0.0327	0.0036	0.0327
	(– 2.28)		(0.11)	
UMD	0.0056	0.0110	0.0074	0.0123
	(0.51)		(0.60)	
UMD_dum	– 0.0007	0.0184	– 0.0243	0.0189
	(– 0.04)		(– 1.29)	
Constant	– 0.0004	0.0003	0.0002	0.0003
	(– 1.43)		(0.69)	
	Number of obs. 528		**Number of obs. 528**	
	R^2 = 0.9801		**R^2 = 0.9746**	

*, ** and *** represents 5, 10 and 15% significance level respectively.

From table 4 we can see that the dummy variables tend to be negative. But it should be noted that not all the results were statistically significant and should therefore not be used in order to draw conclusions. Despite this, the R-square for both portfolios tend to be rather high, suggesting that the variables used in the regression model successfully explain the return of the mutual funds.

We can also observe that the two different portfolios (equally and value weighted) differ to a certain extent. Our hypothesis about a value weighted portfolio showing more exposure to the market portfolio is not supported. Further, the overall significance of the estimated betas for the value weighted portfolio is somewhat lacking in comparison to the equally weighted portfolio.

Table 5

Time period: Jan 1968 – Dec 1988

	Equally weighted portfolio		**Value weighted portfolio**	
Factor	**Coefficient**	**Std. Dev.**	**Coefficient**	**Std. Dev.**
Mktrf	0.8779*	0.0105	0.8991*	0.0211
	(83.30)		(42.71)	
Mktrf_dum	– 0.0457*	0.0193	– 0.0363	0.0305
	(– 2.36)		(– 1.19)	
SMB	0.2311*	0.0151	0.0283	0.0239
	(15.30)		(1.19)	
SMB_dum	– 0.0571**	0.0309	0.0049	0.0439
	(– 1.85)		(0.11)	
HML	– 0.0431*	0.0161	0.0484**	0.0271
	(– 2.68)		(1.79)	
HML_dum	– 0.0714*	0.0334	0.0120	0.0511
	(– 2.14)		(0.24)	
UMD	0.0184	0.0136	– 0.0243	0.0222
	(1.35)		(– 1.09)	
UMD_dum	0.0563*	0.0257	0.0236	0.0392
	(2.19)		(0.60)	
Constant	0.0003	0.0004	0.0004	0.0006
	(0.85)		(0.67)	
	Number of obs. 252		**Number of obs. 252**	
	R^2 = 0.9857		**R^2 = 0.9671**	

*, ** and *** represents 5, 10 and 15% significance level respectively.

Table 6

Time period: Jan 1989 – Dec 2011

	Equally weighted portfolio		**Value weighted portfolio**	
Factor	**Coefficient**	**Std. Dev.**	**Coefficient**	**Std. Dev.**
Mktrf	0.8883*	0.0106	0.9051*	0.0085
	(83.61)		(106.79)	
Mktrf_dum	0.0579*	0.0228	0.0587*	0.0193
	(2.54)		(3.04)	
SMB	0.1386*	0.0150	0.0606*	0.0163
	(9.21)		(3.71)	
SMB_dum	– 0.0720**	0.0419	– 0.1066*	0.0401
	(– 1.72)		(– 2.61)	
HML	0.0293**	0.0158	0.0057	0,0127
	(1.86)		(0.45)	
HML_dum	– 0.1210*	0.0328	– 0.1018*	0.0305
	(– 3.69)		(– 3.33)	
UMD	0.0039	0.0130	0.0241*	0.0092
	(0.30)		(2.60)	
UMD_dum	– 0.0102	0.0180	– 0.0281**	0.0153
	(– 0.56)		(– 1.84)	
Constant	– 0.0010*	0.0004	0.0000	0.0003
	(– 2.44)		(0.07)	
	Number of obs. 276		**Number of obs. 276**	
	R^2 = 0.9807		**R^2 = 0.9863**	

*, ** and *** represents 5, 10 and 15% significance level respectively.

The results from value weighting are less clear-cut. The value-weighted portfolio is still quite statistically insignificant in many of the dummy variables during 1968-88 (table 5). There could be many reasons behind why these results are insignificant, but the most plausible explanations are possibly that the majority of the mutual funds in the value-weighted portfolio do not react uniformly to an economic downturn. However, since we cannot see any big differences in the coefficients between the significant results of the equally-weighted and value-weighted portfolio in period 1989-2011, we have chosen to continue analyzing the results based only on the equally-weighted portfolio.

Looking back at the allocation factors in table 4, 5 & 6, we detect that the dummies demonstrate an underinvestment in small and value firms during times of economic distress. It is interesting to see that the dummy for the market portfolio factor changes, from a negative sign in the early period to a positive sign in the recent period. Regarding momentum, the results for the dummy are irrelevant for the overall period of 1968-2011 (table 4) as well as for the recent interval of 1989-2011 (table 6). However, in the early

period of 1968-88 (table 5) the dummy for momentum imply that equity mutual funds increased their exposure to this factor (with significance).

We want to highlight that since this is a study of how economic downturns affects equity mutual funds allocations, we will not go into any detail on how equity mutual funds are exposed to Carhart's four factors during times of economic expansion.

6 Potential biases in results

6.1 Survivorship biased dataset

The implications following the survivorship bias in the dataset are hard to scope. Fortunately this is not a study on the performance of equity mutual funds – a topic which we believe would have suffered more from a survivorship bias since these studies do research on the rates of returns of managers. Since we investigate how the allocations of equity mutual funds have changed depending on the condition of the economy, we believe that the effects are less distorting. Furthermore, because the 845 equity mutual funds from the first period (1968-88), see table 1, are part of a much larger amount of equity mutual funds during the second period (1989-2011), it is not plausible that these 845 "first" funds are the only ones creating the results observed[16]. If the 845 funds were exhibiting another behavior in comparison with other 29 673[17] equity mutual funds present in the second period, then the results regarding especially the SMB and HML dummies would have paid a price in significance - which they do not appear to have done (these factors are consistent between periods and highly significant).

To control for the survivorship bias we rerun the previous regressions (equation (1)) on a subsample where we have excluded the 845 funds which are mainly responsible for inducing a survivorship bias (see table 8, appendix)[18]. We find support that the results uphold (at least during the more recent period of 1989-2011). However, there could still be some funds remaining (which we are unable to remove) that could cause survivorship bias. Also, it should be noted that by doing this we remove all the observations from the first period (1968-88) and hence we cannot confirm that the observed change for the market portfolio factor is valid with this approach. Neither can we confirm the underinvestment, during economic slumps, in small and value stocks in the first period (1968-88).

Furthermore, comparing the amount of equity mutual funds in our study with the total amount of mutual funds (not excluding any type of mutual fund) that Massimo Massa's

[16] SMB and HML dummies are always negative, Market factor dummy has a trend where it is firstly negative (1968-88) and later positive (1989-2011). See tables section 5, results.
[17] 845 subtracted from 30 518, see table 1.
[18] In addition, we run a regression for equation (1) on only the 845 equity mutual funds from the first period in order to recognize if there is any meaning to excluding them in the first place. Table 9 in appendix confirms that these funds yield the results we have previously obtained. This gives us reason to leave them out so that we can confirm that the results for all the equity mutual funds were not tainted by this (relatively small) group.

study[19] (1998) mentions to be in existence in the US, we can note that our study does not have a particularly inferior amount of funds. While Massa (1998) lists 6,778 mutual funds in the US 1997, our data sample contain 6,279 equity mutual funds in 1997. Note that we are sure to be missing a certain amount of mutual funds when compared to Massa (1998) since we have excluded all fixed income mutual funds. A very large survivorship bias should have resulted in us having a much smaller amount of equity mutual funds in 1997. In clarification; if the vast majority of equity mutual funds from the first period (1968-1988) was terminated before December 31, 1999 (when the character code describing mutual funds as equity or not was introduced by the CRSP) – then the difference between our sample size of equity mutual funds and Massa's (1998) sample of all mutual funds should have been larger.

Overall, we have found some reassurance that our results are not a fabrication of a survivorship bias.

6.2 Duplicated return histories

Another possible source of distortion for our results is that the return histories for some funds could have been duplicated (CRSP, 2011). Since we for every month create an average return in the equally weighted portfolio (giving all funds equal weight is the same as averaging the returns), this could have an effect on the results. A mutual fund in our sample that has split up into different classes and inherited the old returns would have a biasing effect on the outcome since these new classes constitute different mutual funds in the more recent dates, although all have the same performance history in the more distant dates. Whether or not this has affected our results to any magnitude is hard to investigate since we have lack information on which mutual funds that might have been divided.

[19] Massimo Massa's study (1998) is further discussed in section 7; analysis.

7 Analysis

Seeing as we detected a difference in the exposure of equity mutual funds to the market excess return factor when looking at two different groups of recessions separately, we begin by attempting to discern the reason for this.

7.1 Market excess return Factor

As can be seen from the regression tables adhering to the first (1968-88) and second (1989-2011) period (tables 5 & 6 respectively), the market portfolio dummy reacts very differently in the two periods. The former period shows a negative investment trend of mutual funds during contractions, while the latter shows a positive trend. Noteworthy is also that the market portfolio-factor discerning expansions (i.e. not the dummy) increases with time as well. We have found no academic paper mentioning this specific behavior, much less explaining it.

We begin by looking at whether changes in the mutual fund industry, or more specifically the growth of index funds, could explain the increase (change of sign) in the dummy. Since index funds have a beta close to 1, the increase in the number of index funds in the recent period could explain why more investments appear to be allocated to the market portfolio. As Frino et al. (working paper, 2003) mentions, the growth in funds during the 90s was significant, and a large amount of assets (1 trillion USD) was benchmarked to the S&P500 index. Moreover, Malkieal & Radisich (2001) affirms that equity index funds increased in popularity during the 1990s. Approximately 30 % of institutionally managed assets were following an index during the last decade of the 20th century and an ample part of new investments in mutual funds were placed in index funds.

Malkiel & Radisich (2001) claims that the two primary reasons as to why index funds have become more popular is because of less trading costs and management fees. The difference in these have enabled index funds to outperform actively managed funds by 1 -2 % (annually) on a frequent basis. Index funds rarely turns over holdings, while active funds are likely to have around a 50% turnover rate, decreasing the performance of active managers of at least 0.5 % per annum. Active management also demands a much higher management fee than passive index funds require. These conclusions are further supported with the findings of Carhart's paper (1997) as mentioned in section 2.

Due to limited information about the equity mutual funds in our data, we are unable to validate this claim of an increasing amount of index funds[20]. However, judging by the work of Frino et. al (2003) and Malkiel & Radisich (2001), it appears more than likely that during the period of 1989 – 2011 the amount of index funds increased considerably.

However, this increase can only explain why more investments appear to be allocated towards the market proxy in times of economic expansion. More index funds should not automatically boost the dummy since the purpose of the dummy is to portray the effect of contractions in the economy. Index funds will follow an index whether the economy is in a downswing or upswing. That is, index funds should to the best of our knowledge not be alternating their investment style in response to the conditions of the economy. Hence, an increasing amount of index funds should do little to affect the sign and magnitude of the market portfolio dummy. The increase in the dummy should therefore be explained by shifts in allocations of other equity mutual funds which do not have it as a strategy to follow an index.

It is not unreasonable to assume that managers of equity mutual funds were aware of the substantial increase of index funds in their industry of work. We recognize the larger risk aversion that a contraction brings and imagine that managers are concerned of the likeliness that their performance will be evaluated – not only by the investors but also by senior partners at their respective institutions. Knowing that the industry is increasingly dominated by index funds could have triggered a different response in the period of 1989-2011 (when the number of index funds had escalated) where managers were more keen to allocate investments to the market proxy since this was the rate of return that the large amount of index funds would exhibit. Furthermore, by investing a larger amount of assets into the market proxy they would be less exposed to idiosyncratic risk (yet still exposed to systematic risk). Investors ought to prefer limiting any type of risk especially during a crisis when markets tend to act irrationally. We recognize contractions as systematic risk, i.e. you cannot diversify it away. Attempts at stock picking exposes managers to both idiosyncratic risks as well as systematic risk. Hence, it appears possible that for equity mutual funds, the market proxy is a risk minimizing placement for assets.

[20] In the study, it is difficult to estimate the number of index funds included since mutual funds have names such as "Vanguard Index Trust: Vanguard 500 Index Fund; Admiral Shares" or "USAA Mutual Funds Trust: S&P 500 Index Fund; Member Shares", which are clearly index funds. Unfortunately, fund names do not begin with what type of investment strategy they follow. Hence, we cannot sort the data and conclude that a specific proportion of it is index funds.

Another plausible explanation to why the market excess factor increases in time periods independent of recessions or expansions is because of increases in the total number of new mutual funds, which together boosts the exposure to the market portfolio in our results. According to a study conducted by Massimo Massa (1998), the total number of mutual funds in the US had grown from 2,317 to 6,778 in the period 1987-97[21]. He discusses several of reasons why this trend can be observed. Massa claims that the investors' investment decisions are mainly characterized by *limited information* and *heterogeneity*.

Limited information means that investors have difficulties assessing the true quality of the funds' future performance. Hence, investors will take any available information that signals a fund's quality into account when evaluating a fund. It is not uncommon that investors base their assessment of a mutual fund by looking at the performance of other mutual funds held by the same company. A good performance of a specific fund in a mutual fund company will generally benefit the other funds in the same company (spill-over-effect). It is therefore in the mutual fund company's best interest, if they have a well performing fund, to create several other funds – taking advantage of investors' asymmetric information. The mere existence of so called flagship funds, which are funds with extremely low fees but with high returns where the managing corporation takes losses, shows the importance for the fund institutions to have a good performing fund.

The second feature that characterizes the investors' investment decisions is heterogeneity, which means that investors typically want to invest in various different specialized funds – diversifying their investments in order to minimize the idiosyncratic risks. This creates a further incentive for mutual fund companies to create funds that diversifies into different areas of investment. If these funds try to differentiate themselves, the correlation among the return of funds will as a result be relatively low. The aggregated effect of spreading out in this manner will in essence be the same as boosting the similarity of returns to market portfolio, as indicated by our results.

Up until now we have taken account for changes in the mutual fund industry and found little explanation as to why the market factor dummy is negative in the first period and positive in the second. Still, we believe the answer could be found in some literature and research concerning the differences between the early and late recessions and

[21] Comparing the amount of equity mutual funds in our study with the amount of funds in Massa (1998), we find that in 1987 and later in 1997 we had 752 and 6279 equity mutual funds respectively (measured at the end of the years in our study since this is what we assume Massa (1998) did).

investment behavior during these times of economic crisis. With the help of these, we form a hypothesis in what follows.

According to Gylfason et al. (2010) there is a difference in extent and magnitude between the earlier recessions and the later ones. The earlier recessions was less contagious, more isolated and were triggered by local events such as the budget deficits of the US in 1970 created from the Vietnam War, the oil crisis in the early 70s and the energy crisis in 1979. In the more recent recessions the world economy has become more connected where a recession in the US has a larger impact on the rest of the world economy. Notable changes in technology and financial markets are the main reason as to why the global economy has become more intertwined and linked. Therefore, during the first period (1968-88) it was easier for US investors and mutual funds to escape an economic crisis in the US by investing in safer foreign countries. The negative market portfolio dummy may be a consequence of this. But in the second period (1989-2011) – because of contractions with a more global effect – there are fewer places to which US investors can escape.

Giannetti & Laeven (working paper, 2012) have in their recent research found that investors tend to have a home bias during uncertain market conditions such as recessions. Hence, US investors choose to invest in their home country instead of fleeing to other countries in the second period's contractions. Consequently, it would be logical to claim that this would give a boost to the market proxy; US investors become more risk averse during a crisis and turns to the most diverse portfolio on the home investment market, i.e. the market portfolio.

7.2 SMB Factor

It can be noted from table 6, 7 & 8 that the SMB factor shows a general trend where we see an underinvestment in small firms by equity mutual funds during recessions. A possible reason for this behavior is that small firms are less transparent with their business, i.e. small companies are more opaque than larger companies. During recessions when cash becomes a more scarce resource, mutual funds become more risk averse and might try to avoid risky investments such as the stocks of small firms.

According to a recent study by Sahin et. al. (2011), smaller firms performed worse compared to larger firms during the subprime mortgage crisis in 2008. If this is an often occurring trend during recessions, it could partly explain why equity mutual funds are less exposed to the SMB factor during times of economic turbulence. Even though Sahin et.

al.'s findings do not cover all the recessions in our study we believe that their findings are nevertheless noteworthy.

The study further claims that smaller firms tend to rely more heavily on external credit financing through intermediaries, such as banks and other lending institutions, while larger firms can choose from a wider selection of financing, such as direct credit, equity issuance and internal profits etc. During recessions, when credit declines in the banking system, "flight to quality" seems to be a reoccurring phenomenon - resulting in banks and other institutional lenders becoming more selective and risk-averse of whom they lend their money to. Hence, small firms, which rely more on external financing are naturally considered more risky. They are likely to be more affected by a credit crunch. This tightening of financial resources associated with a contraction usually forces smaller firms to reduce their expenses and give up attractive projects that would otherwise increase the company value and profits.

Looking at the findings of Sahin et. al. (2011), we recognize the high likeliness that the underlying reasons why small firms are struck harder during recession (tightening of credit, "flight to quality" and so forth) most likely are present in most, if not all, recessions. It would not be unreasonable to assume that their conclusion could also be applied to other recessions beyond the 2008 credit crunch.

Another reason why smaller firms perform worse during economic slumps is because of the decline in sales – a problem that also affects large firms, but to a lesser degree. Smaller firms are struck much harder from a decline in demand since their credit rating and financial stability is much more dependent on a stable cash flow. When demand declines and becomes more uncertain the whole process creates a downwards spiral where the lower demands results in higher credits-rates, and thus tightens the small firms' investments. This in turns creates a further decline in consumer demands (Sahin et. al, 2011).

7.3 HML Factor

In a similar fashion to the small-minus big factor, managers of equity mutual funds underinvest in value stocks as well during contractions. This implies that for some reason equity mutual funds tend to avoid value firms (high book-to-market ratio) in economic declines.

The underperformance of value firms during economic contractions could be one explanation for this kind of behavior. According to a research done by Kiku (2007), value

and growth firms are exposed to different kinds of risks. Firms with high book-to-market ratio, i.e. value firms, are typically well-established with a fairly high amount of physical capital (machines, buildings etc). Growth firms (often part of the technology industry) receive most of their value, which is not in their books, from growth opportunities in the future.

The conclusion Kiku (2007) came to was that value firms and growth firms differ in their cash-flows exposure to persistent consumption growth, high-frequency consumption risks and news about future discount rates. Value firms tend to be highly sensitive to long-term and low-frequency consumption risks, while growth firms are more sensitive to short-term and high-frequency consumption risks. Growth firms will be less affected by persistent fluctuations in aggregate consumption[22] as long as the growth prospects from assets which cannot be touched, seen or physically weighted are less risky than the physical assets of value firms. Hence, investing in growth firms is regarded as less risky given that they are less disturbed than value firms by long-lasting aggregate shocks and more affected by idiosyncratic and temporary disruptions.

This ought to elucidate why the HML-dummy is negative in all periods; value firms are perceived as more risky because the value of their physical assets are more affected by long-lasting shocks, i.e. recessions, than the intangible assets of the growth firms. Therefore, equity mutual funds most likely assess the value of assets for firms with high book-to-market ratio with high uncertainty when a contraction takes place. When the aggregate consumption decreases, the value of the physical assets will presumably do the same although it is hard to know the scope of this reduction. Consequently, when a contraction hits the economy, equity mutual funds allocate less of their investments to value firms.

7.4 Momentum Factor

Due to the lack of statistical significance for the momentum-factor we cannot come to any conclusion except for the early time period of 1968-88 (see table 4, 5 & 6). During this period, it appears as if managers of equity mutual funds reacted to contractions by investing more in stocks which had momentum. As mentioned, this behavior does not

[22] We regard recessions as long-term and persistent disturbances of the aggregate consumption since they have a lasting effect where they decrease consumption during their duration. The average duration for a contraction in our sample is around 1 year which we deem as a persistent effect on the economy. And, the economy is affected by a crisis once about every 5- 10 years, which should be considered as low-frequency shocks.

uphold when looking at the later time window and nor does it for the entire data period (see table 6 and table 4 respectively).

Where then did this preference, during a period of economic turmoil, for stocks which had previously earned a high return come from? Research on momentum appears to have focused on establishing its existence (Jegadeesh & Titman, 1993), or why the momentum effect exists (Jegadeesh & Titman, 1999), some giving certain attention to behavioral economics when trying to explain its prevalence (Daniel et. al, 1997 and Barberis et. al, 1998). To the best of our knowledge, there exists no present studies on why momentum would have become more attractive for managers of mutual funds during contractions in the period indicated. Although, it is possible that some change in behavior has occurred, for example a change from a more conservative US society in the 1960s and 70s, to a less such during the 90s and the start of the 21th century. More conservative managers might turn to stocks which had previously performed better when the economy is struck by a contraction, explaining why the behavior might only have been occurring in the earlier period. Ultimately, we cannot explain the results regarding momentum and further research is of interest.

8 Conclusion

The purpose of this study has been to investigate whether or not US equity mutual funds allocate their investments differently when the economy heads into a contraction. The results we obtain indicate that this is the case.

During times of economic expansion, we find that equity mutual funds to a high degree have assets allocated to the market portfolio. What might be our most interesting discovery is that the dummy for the market portfolio changes sign as time goes by, the change happening somewhere around the shift into the last decade of the 20th century. Thus, our hypothesis regarding managers of equity mutual funds is confirmed only in the period 1989-2011, where they react to a recession by investing more in the most diverse investment available; the market portfolio. To the best of our knowledge, no previous studies have documented this behavior. We base our explanation for this in research done by Giannetti & Laeven (2012) and Gylfason et. al (2010), arguing that a combination of home bias and a somewhat increasing strength of recessions might elucidate why investment behavior have changed. Further, as technology has evolved, so have the financial markets with it. An increasingly integrated financial world means less safe heavens when a crisis starts – which might be a reason why US equity mutual funds have resorted to investing in the market proxy in their home country. Lastly, in fear of performing worse than what became a major part of the mutual fund industry during the 90s (index funds), managers might have herded towards the market portfolio during times of crisis.

While investments in small firms always seemed to be preferred to some degree in expansions, the value firm approach gave somewhat ambiguous results in a growing economy. However, consistently throughout our study equity mutual funds have reacted to a contraction by investing less in small and value stocks. We believe that the decline in investment allocation towards the small minus big factor in downward times could be accounted for by research done by Sahin et. al (2011), showing that the recent sub-prime mortgage crisis hit smaller firms harder. Being less able than sturdier, well-established companies to cope with the difficulties, such as less demand and credit crunches, that an economic crisis brings, small firms experience weaker performance. Moreover, we believe that larger firms are perceived as less risky also because they are less opaque. Investors can more easily find information about larger firms and in times of economic turmoil – with everyone being worried about incurring losses – finding the desired information could be crucial for an investor.

In empirical research (among others; Fama and French, 1996), the differences in obtained rate of returns between value and growth firms should inspire investors to go long in value stocks and short growth stocks (unconditional on any present state of the economy). However, the difference in characteristics between value and growth firms, as shown by Kiku (2007), turns out to work in the favor of growth firms when the state of the economy heads downwards. Value firms, having their valuation much more tied to tangible physical capital, suffer more from an economic decline. Growth firms might in contrast survive a recession relatively unscathed since they derive their value from future growth prospects. This should account for the trend that we find; during contractions managers of equity mutual funds allocate less of their assets towards the high minus low factor.

Only the results for the period 1968-88 were statistically significant for the momentum dummy variable. We believe that this factor is too noisy during 1989-2011 (creating statistical insignificance when we look at the period 1968-2011 as well). It could very well be that equity mutual funds have a scattered view on how to regard investing in stocks with momentum or simply that they do not change their previous allocations, regarding momentum stocks, during a crisis.

In contrast to an original hypothesis of ours, a value weighted portfolio did not enhance the exposure to the market portfolio during times of crisis. On the contrary, the overall results for a value weighted portfolio were of less statistical significance when compared to an equally portfolio, possibly indicating that there is no general consensus among larger equity mutual funds on how to react to a slump in the economy.

In this final section we want to highlight that we have not found any introduction of new laws for US mutual funds (neither including nor exclusively for equity funds) during the scope of study that could have affected our findings (Hieros- Gamos, 2012). [23]

We hope that this study has emphasized how our results are not to be fully trusted. The survivorship bias ought not to be overlooked. In the end, our results would do well to be further scrutinized, preferably by repeating the study with another dataset and thereby examining whether the results persist.

[23] There was a law passed in 2009 stating, for example, that more transparency in the dealings between brokers/dealers and mutual funds were required. However, this law was introduced in October 2009, and the most recent recession in our study ended in June 2009. Hence, we do not find that this new law should have affected any results regarding dummies for contractions. The second most recent law for US mutual funds came into effect in 1940, which was well before the earliest data in this thesis.

9 Further research

We have explored how mutual funds behave during recessions with their allocation strategies, but no attention has been placed on whether or not a change in strategy as a reaction to a crisis actually pays off. Further research within this field would complement the results we acquired. We acknowledge a study by Robert Kosowski (2006) which looks at the performance of US mutual funds in recessions and expansions. The findings of his paper showed that abnormal returns in recessions are in fact higher compared to the returns achieved during expansions. However, this research cannot, to a full extend, be used in association with our thesis due to the fact that Kosowski (2006) used all types of mutual funds (fixed income funds, commodities and so forth).

Further research could be done to improve our current thesis. As mentioned in section *3.4 data issues* and *6.1 Survivorship biased dataset,* we did have problems with survivorship bias due to the Lipper Classification Codes (character code describing the type of the mutual fund), even though we used survivorship-bias-free data from CRSP.[24] Finding a different classification indicator, enabling an exclusion of all mutual funds except equity funds, without inducing a survivorship bias, and thereafter redoing the study would improve the quality and credibility of the results.

Moreover, we did not get statistically significant results for the momentum factor during all periods. This limited our ability to come to any conclusions regarding it. It should also be noted that we did not have enough system resources to run regressions on all the individual mutual funds through the period 1968-2011. If this had been done instead of creating two portfolios as we did, the results regarding momentum could possibly be improved.

Finally, we would like to create a dataset which excludes index funds. Subsequently, we would recreate the study in order to support our discussion about the change in the mutual fund industry and that a vastly growing amount of index funds during the 1990s still could not explain why the dummy for the market excess return factor would increase in the period 1989-2011.

[24] We want to underline that the survivorship bias was introduced by the authors of this thesis and hence is not an indication of faulty datasets as provided by the CRSP.

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11 Appendix

Table 7

Age Statistics, Survivorship bias

The following table provides a more detailed view of the age of equity mutual funds used in the study. *Implied last year* is the first year when any fund of corresponding year was terminated.

Year	Minimum age (years)	Implied last year
1968	32	2000
1969	32	2001
1970	34	2004
1971	29	2000
1972	37	2009
1973	34	2007
1974	37	2011
1975	36	2011
1976	28	2004
1977	23	2000
1978	27	2005
1979	27	2006
1980	20	2000
1981	19	2000
1982	23	2005
1983	17	2000
1984	16	2000
1985	15	2000
1986	14	2000
1987	13	2000
1988	12	2000
1989	10	1999
1990	10	2000
1991	9	2000
1992	8	2000
1993	6	1999
1994	6	2000
1995	5	2000
1996	3	1999
1997	2	1999
1998	1	1999
1999	0	1999

Note that some last years are 1999. By manual confirmation, those funds that were exhibiting an implied last year of 1999, had their last data entered on December 31, 1999.

Table 8

Testing for effects of survivorship bias

This table represents the results of running equation (1) on a dataset not containing the 845 "oldest" funds (we have excluded the 845 equity mutual funds that were active in the period 1968-88), in an effort to rerun earlier regressions on a sample where the survivorship bias has been mitigated. Hence, we have no observations for 1968-88 here.

Equally weighted portfolio

Time period	**1968-1988**	**1989-2011**
Factor	**Coefficient**	**Coefficient**
Mktrf	-	0.8687* (67.79)
Mktrf_dum	-	0.0712* (2.37)
SMB	-	0.1469* (8.92)
SMB_dum	-	– 0.1160** (– 1.88)
HML	-	0.0247*** (1.47)
HML_dum	-	– 0.1017* (– 2.46)
UMD	-	– 0.0027 (-0.19)
UMD_dum	-	– 0.0049 (-0.23)
Constant	-	– 0.0011* (-2.29)
		Number of obs.= 276
		R^2 = 0.9714

*, ** and *** represents 5, 10 and 15% significance level respectively.

Table 9

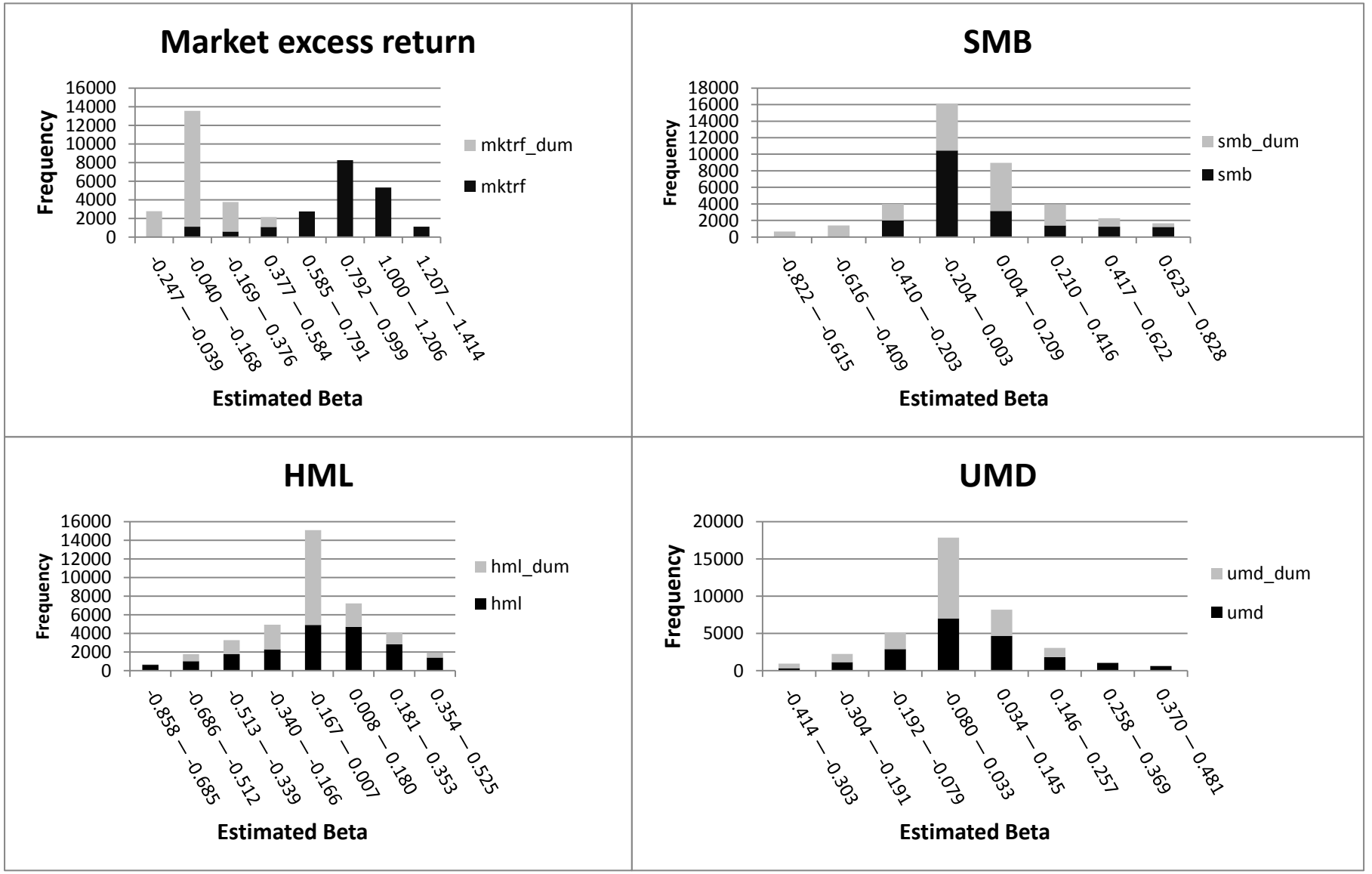
Regression results, funds active in first period

This table exhibits the results from running equation (1) on only the 845 funds that were active already in the first period (1968-1988). Since all funds from the first period survived into the second period (1989-2011) – thereby inducing a survivorship bias, we get results for every time interval contained in this study. We have identified these 845 funds as the ones being the most responsible for the survivorship bias.

	Equally weighted portfolio		
Time period	**1968-2011**	**1968-1988**	**1989-2011**
Factor	**Coefficient**	**Coefficient**	**Coefficient**
Mktrf	0.9031*	0.8779*	0.9047*
	(111.48)	(83.30)	(86.69)
Mktrf_dum	– 0.0139	– 0.0457*	0.0487**
	(-0.70)	(– 2.36)	(1.86)
SMB	0.1498*	0.2311*	0.1173*
	(9.64)	(15.30)	(7.94)
SMB_dum	– 0.0426	– 0.0571**	– 0.0765*
	(– 1.26)	(– 1.85)	(– 2.02)
HML	0.0456*	– 0.0431*	0.0816*
	3.14	(– 2.68)	(5.5)
HML_dum	– 0.1090*	– 0.0714*	– 0.1726*
	(– 3.36)	(– 2.14)	(– 5.21)
UMD	0.0132	0.0184	0.0161
	1.08	(1.35)	(1.32)
UMD_dum	– 0.0021	0.0563*	– 0.0127
	(– 0.11)	(2.19)	(– 0.71)
Constant	– 0.0003	0.0003	– 0.0007**
	(– 1.04)	(0.85)	(– 1.86)
	Number of obs. 528	**Number of obs. 252**	**Number of obs. 276**
	R^2 = 0.9801	**R^2 = 0.9857**	**R^2 = 0.9829**

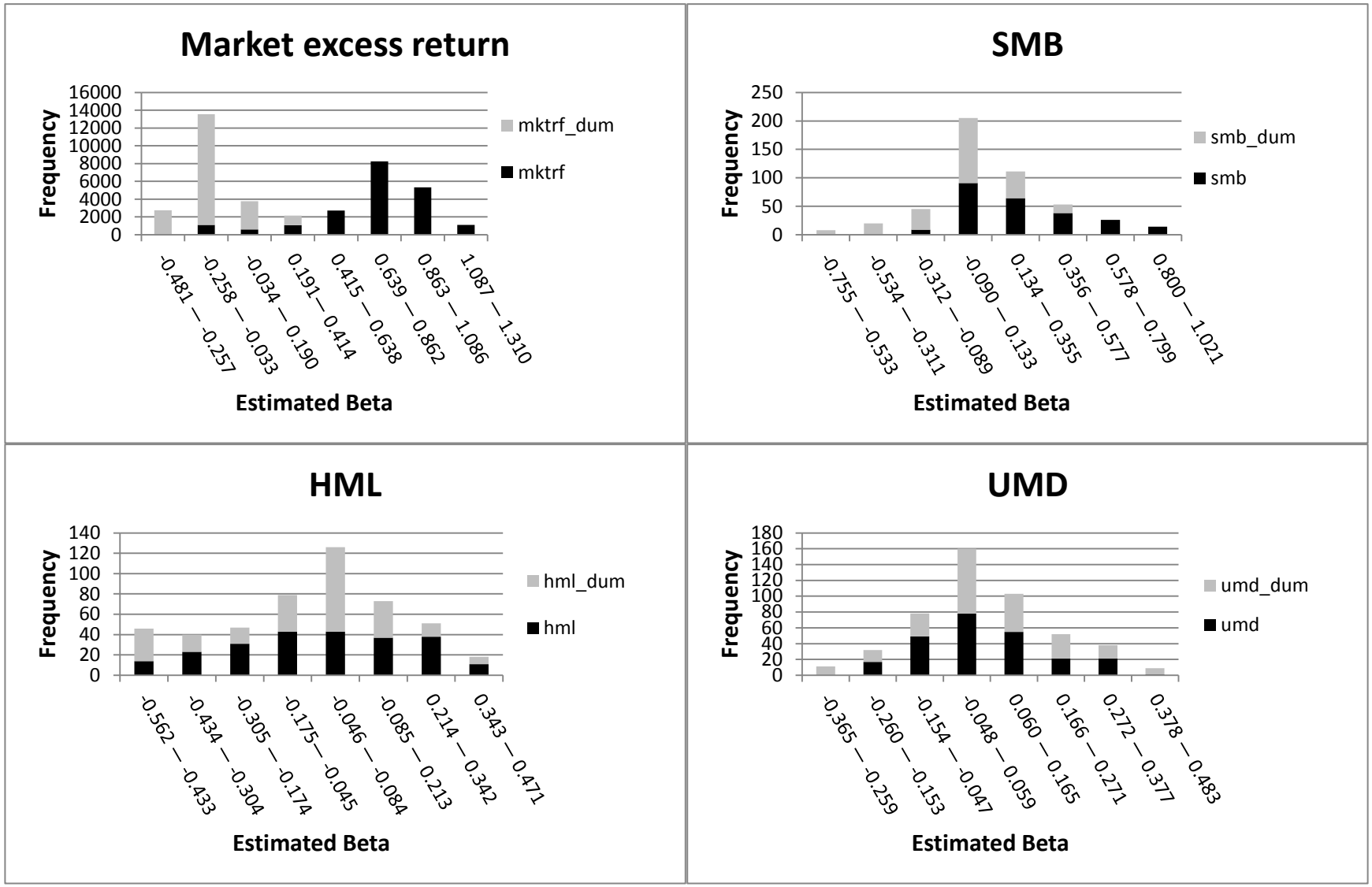
*, ** and *** represents 5, 10 and 15% significance level respectively.

Graph 1. Beta histograms from the most recent recession of January 2008 – June 2009



Values in the ranges outside those displayed were so few in numbers compared to the more centered values that their bars would have been barely visible. Therefore, 5% from each end of the estimated betas was removed. To create the histograms, data from a period of expansion before the contraction was used as well.

Graph 2. Beta histograms from the earliest recession of January 1970 – November 1970



Values in the ranges outside those displayed were so few in numbers compared to the more centered values that their bars would have been barely visible. Therefore, 5% from each end of the estimated betas was removed. To create the histograms, data from a period of expansion before and after the contraction was used as well.